Wide Output Range Power Processing Unit for Electric Propulsion, Phase II

Completed Technology Project (2006 - 2008)

Project Introduction

A power supply concept capable of operation over 25:1 and 64:1 impedance ranges at full power has been successfully demonstrated in our Phase I effort at efficiencies of 96% and above. The benefits of electric propulsion systems are highest when an electric thruster can be operated at high efficiencies over wide ranges of thrust and specific impulse. Hall and ion thruster technologists are close to demonstrating this capability with laboratory and flight model thrusters, and power conversion systems based on the power supply concept demonstrated in our Phase I program will enable wide-ranging operation of these devices. Although ambitious missions with extreme throttling capabilities would now be possible with the CPE wide ranging power supply (WRPS) design, less ambitious (single throttle point) missions are also well served. This is because one power supply design could meet the needs of many different single-throttle-point devices without the need to re-design and re-qualify hardware. We judge that this innovation will save NASA, DoD, and commercial aerospace entities precious non-recurring engineering resources without sacrificing performance.

Anticipated Benefits

Potential NASA Commercial Applications: ELECTRIC VEHICLES: A wide DC power range maximizes the power range for both the motor and the motor's inverter over a wide span of angular velocities. This wide and efficient range reduces the number of transmission shift cycles needed for rapid acceleration. ROBOTICS: Our wide range power converter can supply emergency power to electromechanical drive systems with the minimum stress on the electrical power train. When critical power is needed to avoid mission ending obstacles, our wide range converter can supply the necessary torque or speed required for evasive maneuvering. GRID FLAKE CLEARING: Many power systems for gridded thrusters require a flake busting power converter that is separate from the main power system. When a short occurs the main supplies are then deactivated. Next an auxiliary power converter is switched into the circuit by mechanical relays. The auxiliary supply, which is capable of producing large currents, cleans the flake through a process of evaporation. The wide range supply is also capable of producing large currents and does not need the reliability reducing mechanical switch gear.

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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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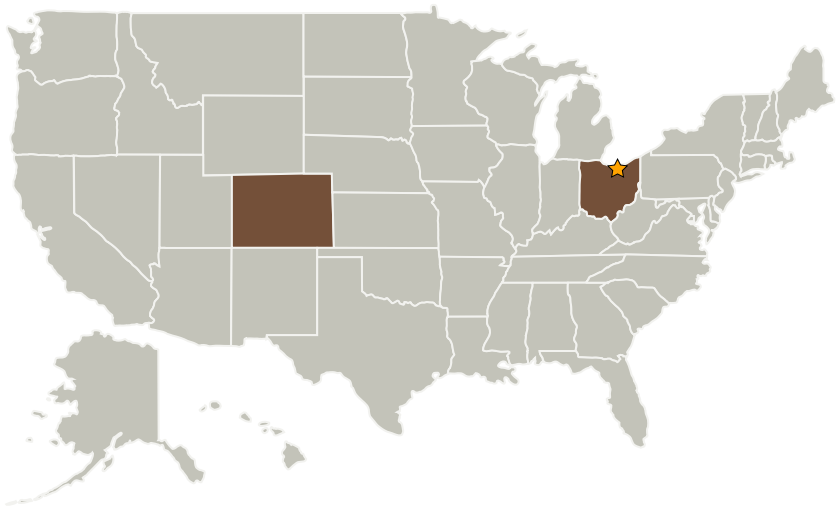
Completed Technology Project (2006 - 2008)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Colorado Power Electronics, Inc.	Supporting Organization	Industry Veteran-Owned Small Business (VOSB)	Fort Collins, Colorado

Primary U.S. Work Locations	
Colorado	Ohio

Project Transitions

December 2006: Project Start

December 2008: Closed out

Closeout Summary: Wide Output Range Power Processing Unit for Electric Pro pulsion, Phase II Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

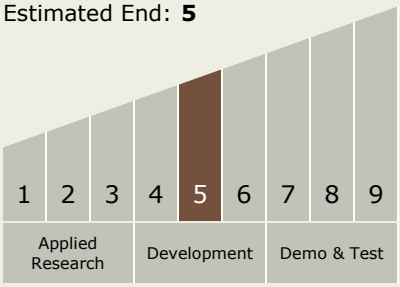
Carlos Torrez

Principal Investigator:

Geoffrey N Drummond

Technology Maturity (TRL)

Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.3 Power Management and Distribution
    - TX03.3.3 Electrical Power Conversion and Regulation